ACCESSION #: 9610020067

LICENSEE EVENT REPORT (LER)

FACILITY NAME: Beaver Valley Power Station Unit 2 PAGE: 1 OF 4

DOCKET NUMBER: 05000412

TITLE: By-pass Feedwater Regulating Valve Leakage Leads to

Manual Reactor Trip During Shutdown for Refueling

EVENT DATE: 08/30/96 LER #: 96-004-00 REPORT DATE: 09/27/96

OTHER FACILITIES INVOLVED: N/A DOCKET NO: 05000

OPERATING MODE: 2 POWER LEVEL: <1%

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION:

50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:

NAME: T.P. Noonan, Vice President Nuclear

Operations and Plant Manager TELEPHONE: (412) 393-7622

COMPONENT FAILURE DESCRIPTION:

CAUSE: B SYSTEM: SJ COMPONENT: FCV MANUFACTURER: M120

REPORTABLE NPRDS: Yes

SUPPLEMENTAL REPORT EXPECTED: NO

ABSTRACT:

During a refueling outage shutdown on August 30, 1996, at 2041 hours, Beaver Valley Power Station Unit 2 initiated a manual reactor trip, as a conservative action, when the average reactor coolant temperature (T sub ave) reached 541 degrees F. The generator output breakers were opened at 1921 hours. Reduced steam flow to the high pressure turbine, due to the governor valves closing to maintain synchronous speed (1800 RPM), resulted in reduced extraction steam to the high pressure (BP) feedwater heaters. Combined with reduced heater drain flows, this caused feedwater temperature to

decrease, as expected. Turbine pedestal testing commenced at 1930 hours, and upon completion, the turbine was tripped at 2004 hours. At 2036 hours, the "A" steam generator wide range level started increasing above 65%, due to a leaking bypass feedwater regulating valve. Feedwater leakage, in conjunction with routine reactor power reduction from control rod insertion, caused a power mismatch and the decline in T sub ave.

The apparent cause of this event was a leaking bypass feedwater regulating valve, combined with a lack of procedural guidance for the control of the consequential excess feedwater.

Corrective actions for this event include: 1) procedures will be revised to provide the operator with guidance for earlier warning capabilities for the detection and for the correction of feedwater leakage or steam header leakage, 2) procedures will be revised to isolate blowdown to help steam generators attain isothermal temperatures prior to reactor shutdown, 3) procedure changes were validated on the simulator prior to implementation, 4) leakage through the bypass feedwater regulating valve will be monitored and evaluated during the upcoming startup, since leakage and "AIRCET" (air operated valve actuator testing and analysis) testing performed under cold conditions did not confirm the existence of excessive leakage.

This event was reported pursuant to the requirements of 10CFR50.72(b)(2)(h) as an event or condition that results in a manual or automatic actuation of an Engineered Safety Feature (ESF), including the Reactor Protection System (RPS). This LER is being submitted pursuant to the requirements of 10CFR50.73(a)(2)(iv) as an event that resulted in manual or automatic actuation of an ESF, including the RPS.

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PLANT AND SYSTEM IDENTIFICATION:

Westinghouse - Pressurized Water Reactor (PWR)

Main Turbine System {TA}*_/

Feedwater System {SJ}*_/

Main Turbine {TA/TRB}*_/

Main Turbine Governor {TA/65}*_/

High Pressure Feedwater Heater and MSR Drains and Vents System {SN}*_/

Heater Drains {SN/DRN}*_/

HP Feedwater Heat Exchanger {SN/HX}*_/

Steam Generator {SB/SG}*_/

Steam Generator Blowdown System - {WI}*_/

*_/Energy Industry Identification System (EIIS) codes and component function identifier codes appear in the text as {SS/CCC}.

CONDITIONS PRIOR TO OCCURRENCE:

Unit 2: Mode 2,

There were no structures, systems or components that were inoperable at the beginning of this event that contributed to the event.

DESCRIPTION:

On August 30, 1996, Beaver Valley Power Station Unit 2 was conducting a plant shutdown for a refueling outage. The generator output breakers were opened at 1921 hours, in preparation for turbine pedestal testing. Reduced steam flow to the high pressure turbine {TA/TRB}, due to the governor valves {TA/65} closing to maintain synchronous speed (1800 RPM), resulted in reduced extraction steam to the high pressure (BP) feedwater heaters {SN/HX}. Combined with reduced heater drain {SN/DRN} flows, this caused feedwater temperature to decrease, as expected. Turbine pedestal testing commenced at 1930 hours. Following the completion of pedestal testing, the turbine was tripped at 2004 hours. At 2036 hours, the "A" steam generator {SB/SG} wide range level started increasing above 65%, indicating that feedwater was being added. Feedwater leakage, in conjunction with the routine reduction in reactor power, which was

already below 1% power from control rod insertion, caused a power mismatch and the decline in T sub ave, At 2041 hours, when T sub ave decreased to 541 degrees F, a manual reactor trip was initiated, as a conservative action. Technical Specifications allow Ta, to be below 541 degree F for 15 minutes when the reactor is critical. However, an automatic ESF actuation (feedwater isolation due to hi-hi steam generator level) was avoided by timely crew diagnostics and corrective actions. Steam generator blowdown {WI} was isolated at 2047 hours, in an attempt to reverse the temperature transient. Normally this would reduce the effect of the temperature decrease, especially when blowdown temperatures are high, but this was not the case, since feedwater temperature was below 127 degree F at this time.

The operations crew performing the shutdown, determined, in a timely manner, that the "A" bypass feedwater regulating valve (2FWS-FCV479) {SJ/FCV} was leaking by, after the reactor trip at 2049 hours. The bypass feedwater regulating valve block valve to the "A" steam generator was closed at approximately 2051 hours.

CAUSE OF EVENT:

The apparent cause of this event was a leaking bypass feedwater regulating valve, combined with a lack of procedural guidance for the control of the consequential excess feedwater.

At 2018 hours, with the reactor power at 7.33%, the differential

temperature (delta - T) or hot leg temperature minus cold leg temperature (T sub h - T sub c) on the "B" steam generator was zero, and at 2039 hours, with reactor power at 1.43%, the "C" steam generator delta-T was similarly zero. This left "A" steam generator as the only steam generator being "steamed off', and consequently, the steam generator receiving the most feedwater, which continued with feedwater temperature now below 127 degrees F. At 2036 hours, the "A" steam generator narrow range dropped below 50%, but the wide range level started increasing above 65%, which indicates feedwater was being added to the "A" steam generator. It was this feedwater leakage, in conjunction with the routine reduction in reactor power from control rod insertion, that caused the power mismatch, and the T sub ave, decline.

ANALYSIS OF THE EVENT:

Since this event involved a manual reactor trip, it is reportable pursuant to the requirements of 10CFR50.73(a)(2)(iv) as "Any event or condition that resulted in a manual or automatic actuation of any Engineered Safety Feature (ESF), including the Reactor Protection System (RPS)..."

For a refueling outage shutdown, the turbine is maintained at synchronous speed to perform turbine pedestal testing. This has the effect of delaying the turbine trip until the test is complete. The pedestal testing commenced at 1930 hours and, upon completion of the testing, the turbine was tripped at 2004 hours. Normally the generator trip and

turbine trip are performed within a few minutes of each other, and feedwater temperature reduction has no significant impact. This is due to feedwater rates being reduced by the operator, once the turbine is tripped and followed up by the reactor shutdown.

In accordance with a "Caution" statement in shutdown procedure 2OM-52.4.C, "Decreasing Power from

at Approximately 5% Power," steam generator levels are maintained in the 40% - 50% of narrow range level prior to opening the generator main output breakers. This is intended to prevent a lo-lo steam generator level reactor trip when steam pressure increases to the condenser steam dump setpoint, after tripping the turbine. After the generator trip transient effects have been stabilized, there is no procedural requirement to reduce steam generator levels to their program values, i.e., 33%, at lower power levels. Steam generator levels were largely maintained in this range. The effects of the feedwater leakage through the bypass regulating valve caused level control on the "A" steam generator to be more difficult when power was reduced, as feed flow rates, due to leakage, exceeded steam flow after the last steam dump valve closed.

This increase in secondary mass inventory can be observed on the wide range steam generator level response as a continuous increase above the 65% expected value for this condition. The increase in steam generator level was also amplified by the effects of the decline in steam pressure,

that started when the last steam dump valve went closed at 2041 hours, and the bypass feedwater regulating valve leakage. In addition, steam generator blowdown was in service until 2047 hours, creating a need for intermittent feedwater additions to replace this steam generator inventory loss, over and above the feedwater additions necessary to replace inventory losses to the main steam system.

Therefore, the steam generator mass inventory represented an increasingly larger heat sink. At 2039 hours, when reactor power went below 1%, the heat removal rate from the primary system (due to low power and bypass feedwater regulating valve leakage) exceeded the primary heat production rate and caused the ensuing drop in reactor coolant temperature.

CORRECTIVE ACTIONS:

1. The "Caution" statement in procedure 2OM-52.4.C will be revised to maintain steam generator levels within their alarm setpoint control bands, and a similar "Caution" statement will be introduced in the Unit 1 procedure, by October 4, 1996.

2. Procedural requirements will be established for both units to isolate blowdown at 5% power to help steam generators attain an isothermal temperature prior to reactor shutdown, by October 4, 1996. Blowdown can be subsequently placed in service, below the point of adding heat, if temperature can be adequately controlled.

3. The turbine pedestal test procedures will be revised for both units

to only require testing of the overspeed trip at 1800 RPM, with the other tests being performed during turbine coastdown, or on the turning gear, by October 4, 1996.

4. Procedural requirements will be established for both units to continuously monitor for a closure of the last steam dump valve below 5% power, by October 4, 1996. Under normal conditions, power can be held at this point until the valve re-opens, indicating that the steam generators have reached an isothermal condition, and provide the crew with an earlier warning for detecting /correcting feedwater leakage or steam header leakage.

5. Procedural requirements will be established for both units for the bypass feedwater regulating valve block valve (to the affected steam generator) to be closed, if the narrow range steam generator level reaches 45%, by October 4, 1996.

6. Procedural requirements will be established for both units to monitor power range indications and loop delta-T's below 5% power, by October 4, 1996. These will include instructions for isolating the Main Steam Isolation Valve (MSIV) and main steam line drains of the affected steam generator if T sub ave cannot be maintained.

7. The above changes were validated for both units on the simulator by September 16, 1996.

8. Leakage through the bypass feedwater regulating valve will be monitored and evaluated during the upcoming startup, since leakage

and "AIRCET" (air operated valve actuator testing and analysis)

testing subsequent to this event, performed under cold conditions,

did not confirm the existence of excessive leakage.

SAFETY IMPLICATIONS:

There were minimal implications to the health and safety of the public

due to this event. Safety systems functioned as designed. Plant

parameters were restored to normal in accordance with plant procedures.

MANUFACTURER DATA:

Bypass Feedwater Regulating Valve 2FWS-FCV479: Masoneilan International

(M120) globe valve, Model 41037.

PREVIOUS SIMILAR EVENTS:

During the past two years, the following similar event has occurred:

LER 1-96-003-01, "ESF Actuation - Feedwater Isolation Due to Steam

Generator Water Level Transient."

Duquesne Light Telephone (412) 393-6000

Nuclear Group

P.O. Box 4

Shippingport, PA 15077-0004 September 27, 1996

NPD2VPO:0529

Beaver Valley Power Station, Unit No. 2

Docket No. 50-412 Licensee No. NPF-73

LER-96-004-00

United States Nuclear Regulatory Commission

Document Control Desk

Washington, DC 20555

In accordance with Appendix A, Beaver Valley Technical

Specifications, the following Licensee Event Report is submitted:

LER 96-004-00, 10 CFR 50.73.a.2.iv, "Bypass Feedwater Regulating

Valve Leakage Leads to Manual Reactor Trip During Shutdown for

Refueling."

T. P. Noonan

Division Vice President

Nuclear Operations/Plant Manager

LB/jd

Attachment

cc: Mr. H. J. Miller, Regional Administrator

United States Nuclear Regulatory Commission

Region 1

475 Allendale Road

King of Prussia, PA 19406

Mr. D. S. Brinkman

BVPS Licensing Project Manager

United States Nuclear Regulatory Commission

Washington, DC 20555

Mr. David Kern

BVPS Senior Resident Inspector

United States Nuclear Regulatory Commission

Mr. J. A. Hultz

Ohio Edison Company

76 S. Main Street

Akron, OH 44308

Mr. Mark Burns

Centerior Energy Corporation

6200 Oak Tree Boulevard

Independence, OH 44101-4661

INPO Records Center

700 Galleria Parkway

Atlanta, GA 30339-5957

Mr. Robert Maiers

Department of Environmental Resources

P.O. Box 8469

State Office Building, 13th Floor

Harrisburg, PA 17105-8469

Director, Safety Evaluation & Control

Virginia Electric & Power Company

P.O. Box 26666

One James River Plaza

Richmond, VA 23261

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